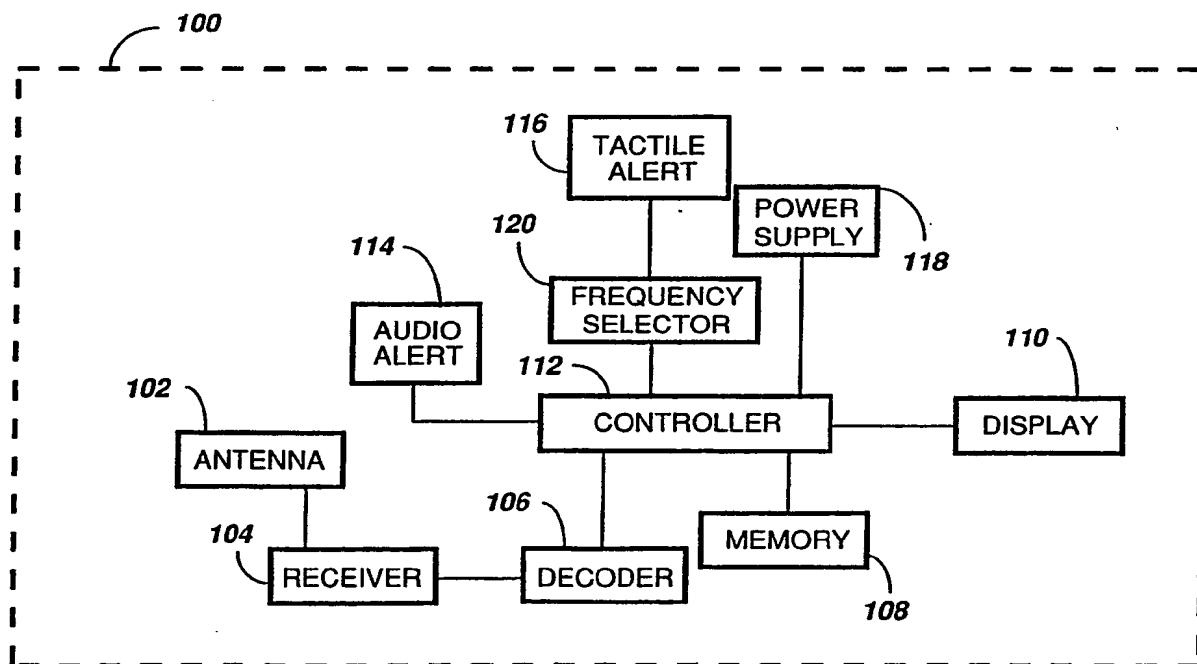




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(21) International Application Number: PCT/US91/03112 (22) International Filing Date: 6 May 1991 (06.05.91) (30) Priority data: 539,404 18 June 1990 (18.06.90) US (71) Applicant: MOTOROLA, INC. [US/US]; 1303 East Algonquin Road, Schaumburg, IL 60196 (US). (72) Inventors: MACDONALD, John, F. ; 4011 N.W. 70th Avenue, Coral Springs, FL 33065 (US). KING, Jeffrey, S. ; 637-7 N.E. 12 Terrace, Boynton Beach, FL 33435 (US). (74) Agents: INGRASSIA, Vincent, B. et al.; Motorola, Inc., Intellectual Property Dept., 1500 N.W. 22nd Avenue, Boynton Beach, FL 33426-8753 (US).		(81) Designated States: AT (European patent), BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, KR, LU (European patent), NL (European patent), SE (European patent). Published <i>With international search report.</i>

(54) Title: SELECTIVE CALL RECEIVER HAVING A VARIABLE FREQUENCY VIBRATOR**(57) Abstract**

A selective call receiver (100) comprises a receiver (104) for receiving a message and a vibrator (116) capable of vibrating at a selected one of at least two selectable frequencies for alerting a user of a received message. The vibrator (116) also has a selector (120) or a tuning element (130) for varying the frequency of the vibrator (116).

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SELECTIVE CALL RECEIVER HAVING A VARIABLE FREQUENCY VIBRATOR

Field of the Invention

5 This invention relates in general to selective call receivers having a tactile alert, and more specifically to selective call receiver having a variable frequency vibrator.

10 Background of the Invention

Electronic devices such as selective call receivers have different methods of alerting a user that a message has been received. One such method of alert is a tactile alert (e.g., vibrational alert), which is conveniently used in business
15 meetings, libraries, and other places where it may be inappropriate to use an audio alert. However, in conventional selective call receivers, the frequency of the vibrator device is usually fixed at some pre-determined frequency. Although the frequency of vibration is fixed, a large variation in the frequency results from the manufacturing process. This causes some users,
20 however, to consider the vibratory mode to be either too high or too low, and as a consequence, a number of these users may avoid using the vibratory alert mode.

Regrettably, however, a selective call receiver having a variable frequency tactile alert has been heretofore unavailable, thus failing to satisfy
25 the varied needs of different users of selective call receivers. Accordingly, a need exists for a tactile alert having a variable frequency of vibration.

Summary of the Invention

30 Briefly, according to the invention, a electronic device comprises a receiver for receiving a message and having a vibrator alert capable of vibrating at a selected one of at least two frequencies. The vibrator also has a selector capability for varying the frequency of the vibrator.

Brief Description of the Drawings

FIG. 1 is a block diagram of a selective call receiver in accordance with a first embodiment of the present invention.

5 FIG. 2 is a block diagram of a selective call receiver in accordance with a second embodiment of the present invention.

Description of a Preferred Embodiment

10 Referring to FIG. 1, a selective call radio receiver 100 (e.g., a pager) comprises an antenna 102 that provides an RF carrier signal that is mixed with a local oscillator signal contained within the receiver module 104. The receiver module 104 generates a recovered signal suitable for processing by a decoder 106 in a manner well known to those skilled in the art. The decoder
15 106 converts the signal to an address. A controller 112 compares the decoded address with one or more predetermined addresses contained in the memory 108. When the addresses are substantially similar, the user is alerted that a signal has been received either by an audio alert (e.g., speaker) 114 or a tactile alert (e.g., vibrator) 116.

20 According to the invention, the frequency of the tactile alert 116 can be varied by varying a frequency selector 120. In this way another vibrating frequency of the tactile alert 116 may be selected.

 In one embodiment, the frequency selector 120 comprises a microcomputer (the controller 112) programmed via conventional
25 techniques to measure a parameter (e.g., the actual vibration, such as, the amplitude of vibration, or the electromagnetic force) of the tactile alert (vibrator alert) 116. Optionally, the microcomputer comprising the frequency selector 120 may monitor a signal, such as, the current or the voltage of the power supply 118, or the electromagnetic force of the tactile alert 116. This
30 information is then used to keep the vibration of the tactile alert 116 substantially constant or at the desired frequency setting. According to the invention, a selected frequency of vibration is held substantially constant, for example, by the microcomputer or the controller 112, which monitors the

current applied to vibrator from the power supply 118. As the battery power decreases (such as by aging) to the point where there is insufficient current to maintain the present frequency of vibration, the microcomputer will select another frequency of vibration such as by comparing the current used to a
5 threshold stored in the memory 108. Other methods of choosing alternate frequencies of vibration may be, for example, according to the voltage supplied from the power supply 118 or the amplitude of vibration of the tactile alert 116.

FIG. 2 shows a selective call receiver 100 similar to FIG. 1 and
10 comprising a second embodiment for varying the frequency of the tactile alert 116. In this embodiment, the selective call receiver 100 includes a tuning hole on a housing (not shown) to permit tuning a tuning element 130 (e.g. a tunable resistor) that is monitored by the controller 112. The controller is responsive to the voltage monitored to vary the drive signal
15 132 to the tactile alert 116. The tuning hole may be located in any suitable location on the selective call receiver, such as, under a removable conventional belt clip, under a battery door on the housing, within a code plug programming slot, under a housing lock opening, or under labels etc. on the selective call receiver 100.

20 Accordingly, varying the current or voltage using known techniques may also be used to vary the frequency of the tactile alert 116, which in another aspect of the invention may be measured using one of the several known techniques, such as, frequency counters or pressure sensor feedback systems that are commercially available from manufactures such as TDK or
25 Murata. After measuring the vibration of the tactile alert 116, information relating to the selected frequency may be displayed on the display 110 of the selective call receiver 100.

In summary, a variable frequency vibrator allows the user to preset a desired frequency of vibration. The preset frequency is held constant by a
30 microcomputer or the like over an active range of the power supply, and after further discharge of the power supply 118 (e.g., below the active range), the microcomputer will measure a parameter from the power supply 118 or the tactile alert 116 to select the next suitable frequency of vibration.

Additionally, the selective call receiver 100 may display the selected frequency of vibration setting on the display 110.

CLAIMS

1. An electronic device comprising:
a receiver for receiving a message;
5 a vibrator capable of vibrating at a selected one of at least two frequencies for alerting a user of a received message, and selector means for selecting the frequency of vibration.
2. The electronic device according to claim 1 wherein the selection means
10 comprises tunable means for adjusting the signal applied to the vibrator.
3. The electronic device according to claim 1 wherein the selection means comprises:
sensor means for sensing a characteristic of the vibrator; and
15 controller means for adjusting a parameter of the vibrator in response to the sensor means so as to maintain a rate of vibration.
4. The electronic device according to claim 3 wherein the characteristic
20 comprises a current for driving the vibrator.
5. The electronic device according to claim 3 wherein the characteristic comprises a voltage for powering the vibrator.
6. The electronic device according to claim 3 wherein the characteristic
25 comprises the frequency of the vibration.
7. The electronic device according to claim 3 wherein the characteristic comprises an amplitude of the vibration.
- 30 8. The electronic device according to claim 3 wherein the characteristic comprises an electromagnetic force emitted from the vibrator.

9. The electronic device according to claim 1 wherein the selection means comprises a display means for displaying information relating to a selected frequency.
- 5 10. The electronic device according to claim 3, the electronic device capable of being powered by a power source providing a voltage output that may vary over a voltage range, the controller providing a constant signal to the vibrator over the voltage range.
- 10 11. The electronic device according to claim 3 wherein the means for adjusting the signal applied to the vibrator comprises a micro-computer circuit.
12. A selective call receiver comprising:
- 15 a receiver for receiving selected messages;
a vibrator for alerting a user of the selective call receiver of a received message;
a power source; and
a tunable element coupled between the power source and the vibrator
- 20 for setting the frequency of the vibrations of the vibrator.
13. The selective call receiver according to claim 12 further comprising a controller coupled between the tunable element and the vibrator for controlling the signal supplied to the vibrator in response to a characteristic
- 25 of the vibrator.
14. In an electronic device for providing a tactile alert of a received message to a user of the electronic device, a method comprising the step of adjusting the frequency of the tactile alert.
- 30 15. The method according to claim 14 further comprising the step of sensing a characteristic of the tactile alert and adjusting the frequency in response thereto.

16. The method according to claim 15 wherein the sensing step comprises sensing a voltage for powering the vibrator.

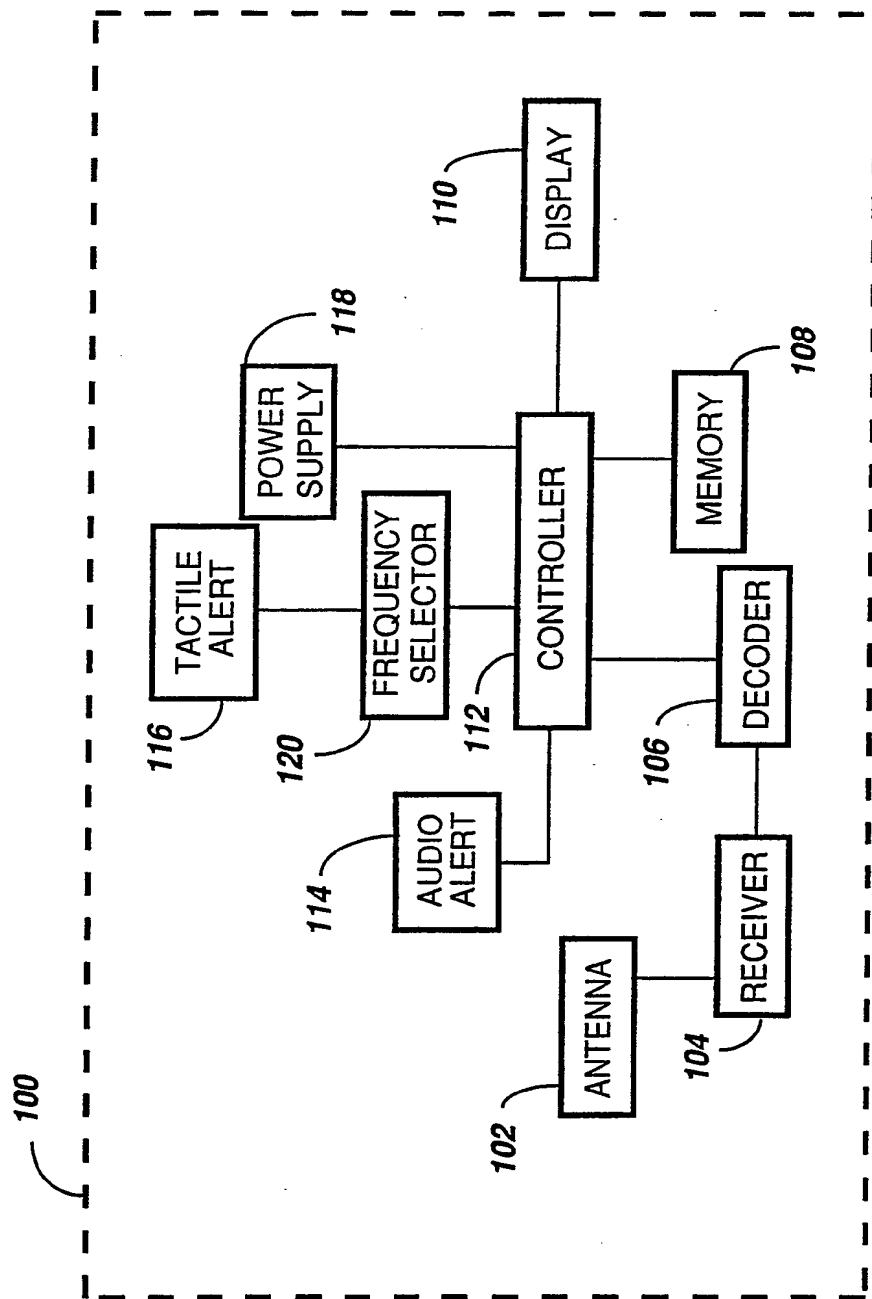
5 17. The method according to claim 15 wherein the sensing step comprises sensing the frequency of the vibration.

18. The method according to claim 15 wherein the sensing step comprises sensing a current for driving the vibrator.

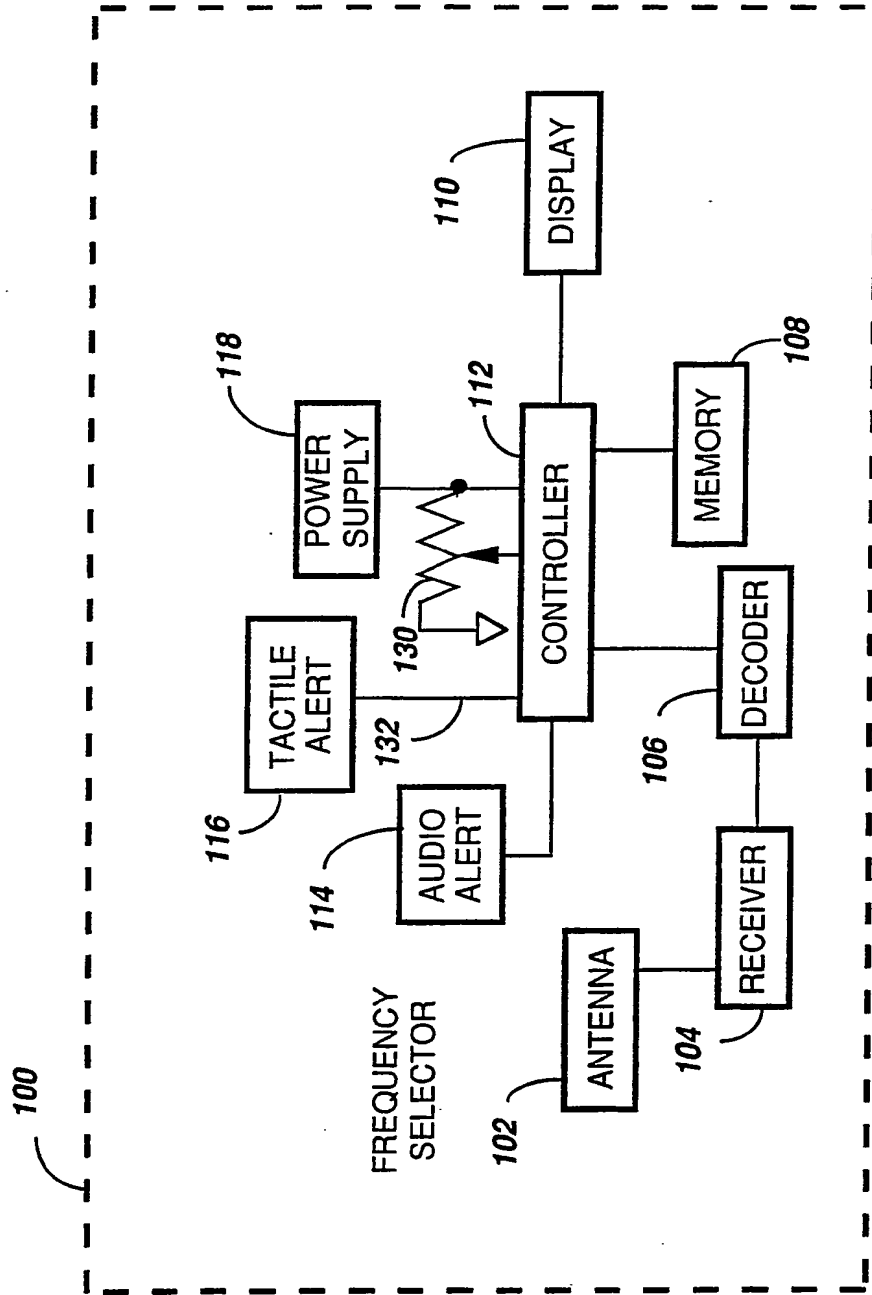
10 19. The method according to claim 15 wherein the sensing step comprises sensing an amplitude of vibration of the vibrator.

15 20. The method according to claim 15 wherein the sensing step comprises sensing an electromagnetic force emitted from the vibrator.

1/2

**FIG. 1**

2/2

**FIG. 2**

INTERNATIONAL SEARCH REPORT

International Application No. PCT/US91/03112

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC(5): HO4B 7/00 US CL.: 340/825.44, 825.47, 825.48, 825.46, 311.1; 368/245																							
II. FIELDS SEARCHED <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black; margin: 5px 0;">Minimum Documentation Searched ⁷</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 30%; border: 1px solid black; text-align: left; padding: 5px;">Classification System</th> <th style="border: 1px solid black; text-align: left; padding: 5px;">Classification Symbols</th> </tr> <tr> <td style="border: 1px solid black; padding: 5px;">US CL</td> <td style="border: 1px solid black; padding: 5px;">340/825.460, 825.440</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black; margin: 5px 0;">Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸</div>			Classification System	Classification Symbols	US CL	340/825.460, 825.440																	
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III. DOCUMENTS CONSIDERED TO BE RELEVANT ⁹ <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 10%; border: 1px solid black; text-align: left; padding: 5px;">Category ⁹</th> <th style="border: 1px solid black; text-align: left; padding: 5px;">Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²</th> <th style="border: 1px solid black; text-align: left; padding: 5px;">Relevant to Claim No. ¹³</th> </tr> <tr> <td style="border: 1px solid black; text-align: center; padding: 5px;">X</td> <td style="border: 1px solid black; padding: 5px;">JP, A, 1-227535 (OHATA) 11 September 1989 Note abstract</td> <td style="border: 1px solid black; text-align: center; padding: 5px;">1-20</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; padding: 5px;">Y</td> <td style="border: 1px solid black; padding: 5px;">US, A, 4,233,679 (Schwarzschild) 11 November 1980 Note abstract</td> <td style="border: 1px solid black; text-align: center; padding: 5px;">2,13,14</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; padding: 5px;">Y</td> <td style="border: 1px solid black; padding: 5px;">US, A, 4,731,603 (McRae et al) 15 March 1988 Note abstract, col.9, lines 32-56</td> <td style="border: 1px solid black; text-align: center; padding: 5px;">2,13,14</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; padding: 5px;">Y</td> <td style="border: 1px solid black; padding: 5px;">US, A, 4,576,484 (Grossmeyer) 18 March 1988 Note abstract, col.1, lines 21-27; col.2, lines 35-47; col.3, lines 1-18, 38-48, 50-57</td> <td style="border: 1px solid black; text-align: center; padding: 5px;">1-20</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; padding: 5px;">Y</td> <td style="border: 1px solid black; padding: 5px;">US, A, 4,786,902 (Davis et al) 22 November 1988 Note col.5, lines 4-11</td> <td style="border: 1px solid black; text-align: center; padding: 5px;">1-20</td> </tr> <tr> <td style="border: 1px solid black; text-align: center; padding: 5px;">Y</td> <td style="border: 1px solid black; padding: 5px;">US, A, 3,623,064 (Kagan) 23 November 1971 Note col.1, lines 30-50; col.2, lines 34-45, 68-75</td> <td style="border: 1px solid black; text-align: center; padding: 5px;">1-20</td> </tr> </table>			Category ⁹	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	X	JP, A, 1-227535 (OHATA) 11 September 1989 Note abstract	1-20	Y	US, A, 4,233,679 (Schwarzschild) 11 November 1980 Note abstract	2,13,14	Y	US, A, 4,731,603 (McRae et al) 15 March 1988 Note abstract, col.9, lines 32-56	2,13,14	Y	US, A, 4,576,484 (Grossmeyer) 18 March 1988 Note abstract, col.1, lines 21-27; col.2, lines 35-47; col.3, lines 1-18, 38-48, 50-57	1-20	Y	US, A, 4,786,902 (Davis et al) 22 November 1988 Note col.5, lines 4-11	1-20	Y	US, A, 3,623,064 (Kagan) 23 November 1971 Note col.1, lines 30-50; col.2, lines 34-45, 68-75	1-20
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>⁹ Special categories of cited documents: ¹⁰</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>																							
IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border: 1px solid black; padding: 5px;"> Date of the Actual Completion of the International Search 20 June 1991 </td> <td style="width: 50%; border: 1px solid black; padding: 5px;"> Date of Mailing of this International Search Report <div style="font-size: 1.5em; font-weight: bold;">10 JUL 1991</div> </td> </tr> <tr> <td style="border: 1px solid black; padding: 5px;"> International Searching Authority ISA/US </td> <td style="border: 1px solid black; padding: 5px;"> Signature of Authorized Officer JOHN E. GUIST </td> </tr> </table>			Date of the Actual Completion of the International Search 20 June 1991	Date of Mailing of this International Search Report <div style="font-size: 1.5em; font-weight: bold;">10 JUL 1991</div>	International Searching Authority ISA/US	Signature of Authorized Officer JOHN E. GUIST																	
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